UNILAC status report

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Operation

After 13 months of shutdown, the UNILAC commissioning began in early January with the start up of all devices and systems. The first beam accelerated to full UNILAC energy ($^{40}Ar^{10+}$ from the PIG) was recorded on 29 January 2014. On 9 February the first beam ($^{40}Ar^{8+}$) was available in the transfer channel and was subsequently delivered for the commissioning of the synchrotron. The busy, but — having the long shutdown in mind — quite successful commissioning ended on 13 February 2014. Still, operation was affected by numerous and frequent interruptions and breakdowns, though. The major drawback was, that some rf cavities needed additional conditioning in order to accelerate $^{238}U^{28+}$, which was requested for the SIS18 commissioning already. $^{238}U^{29+}$ with less intensity had to be chosen several times throughout the year.

The UNILAC was in operation for nearly 250 days, restricted to two ion species in parallel in order to compensate for the tight beam time schedule in 2014. Delivering high current beams of ^{14}N (CHORDIS), ^{58}Ni (VARIS), ^{1}H and ^{86}Kr (both MUCIS) to the synchrotron for physics experiments and machine development dominated the operation. At UNILAC energies material sciences, biology and SHE experiments (TASCA, SHIPTRAP) were the main recipients for ^{197}Au, ^{209}Bi (both PIG), ^{48}Ca and ^{50}Ti (both ECR). ^{238}U (MeVVA), ^{124}Xe (MUCIS) and ^{132}Xe (PIG) were accelerated for physics experiments and machine development both at the UNILAC and SIS18. Shorter beam times with ^{56}Fe and ^{153}Sm (both PIG) have been conducted mainly for physics experiments, while $^{2}H_3^+$ (MUCIS) was accelerated for EMTEX (see below), and ^{20}Ne (PIG) for HITRAP. The HLI also provided four weeks of ^{12}C, mainly for therapy development, and ^{22}Ne for TASCA.

For the first time a high current proton beam was accelerated for the synchrotron by cracking $^{15}CH_3^+$ (CHORDIS) in the gas stripper, thereby delivering 2 mA ($7{\cdot}10^{11}/100\mu$s) of protons with very good beam quality [1, 2].

Shutdown Activities

Due to the short shutdown periods in 2014, no major activities had been carried out. The second buncher cavity in the Alvarez section (BB6) could not be operated at high power levels due to a blocked cooling channel of the spiral. After several rinsing attempts it was finally removed from the beamline, repaired in the workshop during the second beamtime period, and placed back in November. Additionally, two inner tank triplets of the first HSI-IH tank had ground fault. They were operated by means of a work around, one of them will be repaired during the shutdown 2014/15. One drift tube in the Alvarez I tank has a vacuum leak, it will be replaced this year.

Machine Experiments

In May and October successful tests were carried out by the source department to reach higher proton beam intensities by accelerating molecules like $^{15}CH_3^+$ and $C_2H_6^+$ from the MUCIS and crack them in the gas stripper [3]. Increasing the intensity, especially for heavy ions, by using a pulsed gas jet with different gases and thereby increasing the stripping efficiency, also was the topic of very successful machine experiments in February and November conducted in close collaboration with TASCA [4, 5]. Three accelerator beamtimes were dedicated to the emittance transfer experiment EMTEX [6, 7]. During several machine experiments new rf working points for all HSI accelerator cavities were identified using $^{181}Ta^{4+}$, and rf breakdowns of the superlens were investigated. Experimental data for advanced DYNAMION simulations of the matching of high current beams to the HSI-RFQ were gathered, and multi charge operation of the poststripper section was studied [8]. In autumn, the amplitude calibration of the bunchers US4BB3 and BB4 was investigated and emittance measurements along the whole UNILAC, especially behind the poststripper section, were conducted [8], besides experiments of the beam diagnostics department related to the longitudinal beam structure. In total, 179 shifts were staffed by the linac department, including assistance for three successful HITRAP beamtimes [9].

References

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